SUPPLEMENT TO "SAMPLE GEAR CALCULATIONS AND USE OF "TRIG." TABLES AND INVOLUTE FUNCTIONS"

Sample Calculations for calculating --

Page A	**Contact Ratio or Tooth Overlap**
Page B	**Involute Profile Control, Scale Readings and Degrees of Roll**

for Internal Parallel Axis Gearing.

NOTE! The 78-tooth gear used for an example on Pages 1 through 7 has been changed to an internal gear for Pages A and B.

78-tooth internal gear I. D. = 3.8375 and C = 1.3125.

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CONTACT RATIO OR TOOTH OVERLAP (Internal)

Known:

	Pinion #1	**Gear #2 (Internal)**
Base Radius	$b_1 = .61598$	$b_2 = 1.84794$
Pitch Radius	$p_1 = .65625$	$p_2 = 1.96875$
Outside Radius	$d_1 = .70625$	- - -
Inside Radius	- - -	$d_2 = 1.91875$
$C = 1.3125$	$TBP = .14886$	$TCP = .15895$
$HA = 7^\circ\ 55'$		

(1) $\text{Cos } M_1 = \dfrac{.61595}{.70625} = .87214$ $\qquad$ $\text{Cos } M_2 = \dfrac{1.84795}{1.91875} = .96310$

$M_1 = 29^\circ\ 17'\ 30''$ $\qquad$ $M_2 = 15^\circ\ 36'\ 45''$

$\text{Sin } M_1 = .48926$ $\qquad$ $\text{Sin } M_2 = .26914$

(2) $Zd_1 = .70625 \times .48926 = .34554$ $\quad$ $Zd_2 = 1.91875 \times .26914 = .51641$

(3) $\text{Cos } OPA = \dfrac{b_2 - b_1}{c} = \dfrac{1.84794 - .61598}{1.3125} = .93863$

$OPA = TPA = 20^\circ\ 10'\ 36''$

(4) $ZL = c \times \text{Sin } OPA = 1.3125 \times .34492 = .45271$

(5) $\text{Contact Ratio} = \dfrac{Zd_1 - Zd_2 + ZL}{TBP}$

Contact Ratio (Involute) $= \dfrac{.34554 - .51641 + .45271}{.14886}$ $= 1.89$

(6) Contact Ratio (Face) $= \dfrac{\text{Face Width} \times \text{Tan } HA}{TCP}$

Face Width = .500

Contact Ratio (Face) $= \dfrac{.500 \times .13906}{.158}$ $= 0.44$

Helical Gear Only

(7) Total Contact Ratio = Contact Ratio (Involute) + Contact Ratio (Face) $\doteq 2.33$

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(b)

INVOLUTE PROFILE CONTROL, SCALE READINGS AND DEGREES OF ROLL

Known: Use Data from Sheet (a).

Z = Length of line of action to point indicated.
S = Scale reading on involute machine.
$^{\circ}\text{Roll}$ = Roll angle.

For Gear #2 -- 78 Teeth (Internal)

$$Z_{a_2} = ZL + Zd_1 = .45271 + .34554 = .79825$$

$$Z_{p_2} = P_2 \times \text{Sin OPA} = 1.96875 \times .34492 = .67906$$

$$Z_{d_2} = .51641 \text{ (From Sheet (a))}$$

Scale Reading: $20 \times Z$

$$S_{a_2} = 20 \times .79825 = 15.96$$

$$S_{p_2} = 20 \times .67906 = 13.58$$

$$S_{d_2} = 20 \times .51641 = 10.32$$

$^{\circ}$Roll from Z Values

$$^{\circ}\text{Roll} = \frac{57.2958 \times Z}{b}$$

$$^{\circ}\text{Roll}_{a_2} = \frac{57.2958 \times .79825}{1.84794} = 24.75^{\circ}$$

$$^{\circ}\text{Roll}_{p_2} = \frac{57.2958 \times .67906}{1.84794} = 21.05^{\circ}$$

$$^{\circ}\text{Roll}_{d_2} = \frac{57.2958 \times .51641}{1.84794} = 16.01^{\circ}$$

Also Conversion of Scale Reading to $^{\circ}$Roll, etc.

$$^{\circ}\text{Roll} = 2.8648 \times \frac{S}{b}$$

$$S = .34906 \times b \times {}^{\circ}\text{Roll}$$

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